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**Critical Literature Review  
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***Exploring the Underlying Motivations of the Antarctic  
Scientists of the Heroic Age.***

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Abstract (202 words):

Scientific discovery in the Heroic Age of Antarctic exploration, the ten years commencing 1907, was extremely demanding and carried great risk. The working conditions of the scientists within the expedition teams led by Shackleton, Charcot, Shirase, Filchner, Mawson, Scott, and Amundsen varied greatly. Scott ran a comprehensive scientific institute, appointing a capable team of scientists, encouraging ongoing scientific pursuit with regular lecture series and providing the necessary logistical support, alongside his sporting pursuits. Charcot and Mawson led expeditions purely for scientific purposes. Shackleton and Charcot each endeavoured to provide a similar science setting to Scott's, but were limited by geographical challenges and personnel issues. The scientists who travelled with Amundsen or with Shirase worked in comparative isolation, but achieved notable scientific work. In all instances, the scientists themselves were highly motivated for scientific discovery in extreme conditions. The accolades, publishing opportunities and financial gain that may have come to them after the expeditions were not the main source of their motivation for undertaking such work. It was the work itself, the extreme environment it existed in, and the people they were working alongside, which collectively provided the main motivation for the scientists to explore within the Antarctic expeditions of the Heroic Age.

## Table of Contents

Abstract .....	1
Table of Contents .....	2
Introduction.....	2
Leadership providing motivation.....	3
Personal interest or drive.....	4
The Incentive .....	5
The process of science .....	6
Limitations .....	7
Conclusion.....	7
References.....	8

## Introduction

The isolation and extreme conditions of Antarctica places many demands on scientific exploration. The major demands on personnel one hundred years ago were in the realms of tolerating extreme discomfort and risk. This review seeks to explore the motivation that was strong enough for scientists of the turn of the last century to venture south and face these risks. To understand the motivation of the scientists who explored Antarctica in the Heroic Age, we need to look at the definitions of the word motivation.

“Mo+ti+va+tion *n.* **1.** The act or an instance of motivating. **2.** Desire to do; interest or drive. **3.** Incentive or inducement. **4.** *Psychol.* the process that arouses, sustains and regulates human and animal behaviour.” (Collins, 1979, p. 961)

Each of these four definitions will be explored in this review, in terms of the **underlying** motivations being the motivations which acted on the long term decision-making to undertake science in the Antarctic of the Heroic Age.

The period in history known as the Heroic Age of Antarctic exploration has a variety of definitions. The common group of expeditions are those of the ten years that begin with Sir Ernest Shackleton’s *Nimrod* (1907-1909) and continues with the expeditions of Jean Baptiste Auguste Charcot (1908-1910), Nobu Shirase (1910-1912), Wilhelm Filchner (1911-1912), Douglas Mawson (1911-1914), Robert Falcon Scott’s *Terra Nova* (1910 – 1913), Roald Amundsen (1910 – 1912) and ends with Shackleton’s *Aurora* and *Endurance* (1914 – 1916) expeditions. This decade of exploration follows a time of much exploration of shipping routes and the earliest expeditions to the Antarctic region and the continent itself. It was a time of great breakthroughs in science, such as Charles Darwin’s work in evolution which challenged many religious views. Nestled between the Boer War and the into the First World War, it was a time of many wars, when countries such as Great Britain showed their strength with strong naval forces and by occupying many colonies. Many of the people recruited for these expeditions were military men and the organisation of each venture had the hierarchy with which they were familiar. The discipline that came with these military ways showed through into the ranks of the scientists taking part in the Antarctic expeditions of the Heroic Age (Kirwan, 1962; Rack, 2015; Tingey, 1983; Turney, 2012).

## Leadership providing motivation; the act or an instance of motivating

The task of motivating scientists on an Antarctic expedition was a major responsibility of the chief scientist. Scott's *Terra Nova* expedition included 12 scientists led by Edward (Bill) Wilson. Wilson showed a passion for science and a flair for igniting such passion in others. Together with Scott, particularly in times of confinement such as when sailing or during winter, he and Scott ensured the sharing of expertise and enthusiasm through regular lectures, given by the officers and the scientists. The appointments process to this scientific team was intended to ensure that each member was an expert in his field, fit and willing to explore and that he had adequate time to prepare for the expedition. Despite numerous requests, Shackleton was unable to engage Wilson for his *Nimbus* expedition, as the journey clashed with his work on grouse disease. This may have been partly an excuse made by Wilson given that at the same time, Scott was contesting Shackleton's intention to base his *Nimrod* expedition at Hut Point. Shackleton could not understand Wilson's loyalty to complete his current research obligations, writing "It is the country before the grouse." in one of his many telegrams to Wilson (Seaver, 1946, p. 174). Seeking glory for king and country was not sufficient motivation for Wilson, but it may have been enough for the Japanese scientists who joined the second part of Shirase's expedition. The first part had been a much criticised unsuccessful attempt to reach the South Pole, resulting in a retreat to Australia to face poverty and public ridicule. At that time, Japanese politicians and military leaders stated their obvious contempt towards the inclusion of any scientists on such a voyage. When it became obvious that Shirase was not able to deliver on geographic goals, he changed his focus to that of science, particularly of ice formation, and set about assembling a small team under the guidance of an experienced Antarctic scientist, Tannatt William Edgeworth David and funded by Japanese nobleman, Count Okuma. The small team of three scientists and expedition support were farewelled from Australia with a motivating telegram from Okuma urging them to not to think of returning until they had achieved their aims, even if it meant they were to perish (Cherry-Garrard, 1994; Ennis, 2010; Harrowfield, 2015; Kirwan, 1962; McInnes, 2010; Ponting, 1928; Riffenburgh, 2004; Shackleton, Stevenson, 2011; The Shirase Antarctic Expedition Supporters' Association, 2011; Tingey, 1983; Turney, 2012).

The Antarctic expedition leaders of the Heroic Age contributed varying levels of motivation for the scientists in their teams. Scott, Charcot, Mawson and Amundsen each showed a personal interest in science, reflected in their choice of personnel and objectives, with Scott, Charcot and Mawson setting up comprehensive science programmes and Amundsen building a focussed project that aided rather than interfered with his polar goals. Amundsen's primary goal was to be the first to get to the pole; initially it was to be the North Pole, but this objective changed at a very late stage to the South Pole. Although some historians have overlooked the scientific work on his Amundsen's expedition, it yielded useful studies in oceanography. Shackleton and Shirase, themselves, were not so interested in Antarctic science, but appreciated the funding and profile that came with the pursuit of science and each endeavoured to develop a science programme. The scientists of Shackleton's *Nimrod* and Shirase's expeditions, were fortunate in having scientific guidance provided by Edgeworth David. A seasoned Antarctic explorer himself, Edgeworth David had a broad understanding of the Antarctic knowledge of the time, providing expert guidance in the setting of objectives for study. Also under the mentorship of Edgeworth David was

Douglas Mawson who funded his own purely scientific expedition. Mawson had studied under Edgeworth David and then worked closely with him on Shackleton's *Nimrod* expedition (Bickel, 1977; Bomann-Larsen, 2014; Cherry-Garrard, 1994; Kirwan, 1962; Rack, 2015; Riffenburgh, 2004; Schillings, 2015; Turney, 2012).

Shackleton's *Aurora* expedition included a group of scientists termed the Ross Sea Party who experienced many barriers to carrying out scientific work in addition to the extremes of the Antarctic. The Ross Sea party comprised four capable scientists of mixed backgrounds and fitness, who undertook much scientific observation with limited resources in demanding conditions. The scientists Alexander Stevens, a geologist and the Chief Scientist, and John Cope, a biologist, were appointed in Britain so were able to be involved in some of the earlier planning of the expedition. Two Australian scientists, Andrew Jack, a chemist and Richard Walter Richards, another physicist, were appointed after the expedition was underway, so had input into neither the planning of the expedition nor in the equipment to be taken. The range of objectives that were planned and resourced included geology, glaciology, meteorology and biology. Although Stevens had questioned that there remained any dispute over the embryology of the emperor penguin, the expedition included Cope's wish to continue the investigation into the evolutionary role of the emperor penguin. Five previous expeditions had been focussed on the emperor penguin colony at Cape Crozier, led by Wilson with field work that included the winter journey of 1911. When the Ross Sea party had difficulty landing at Cape Crozier, conflict arose between the scientists themselves. It would be difficult to avoid a feeling of disappointment, having travelled such a distance, being unable to access a key field site at the last minute. The tensions that arose have been attributed to difficulties in carrying out the planned scientific activities, to differences in approach to working within a team of scientists and to Steven's lack of clear scientific leadership. Although useful scientific work was carried out over the time the Ross Sea party was in the Antarctic, Stevens was deeply unhappy about his time spent there and spoke very little of it on his return. Shackleton's Ross Sea party, lacked a strong scientific leader and so lacked the planning and the ongoing motivation that such a leader would provide (Harrowfield, 2015; Kirwan, 1962).

## Personal interest or drive

Contrasting with Stevens' lack of pride in the science of his expedition, Apsley Cherry-Garrard was fiercely proud of having been a part of Wilson's efforts to study the embryology of the emperor penguin. Being the only member of the three man 1911 winter journey from Cape Evans to Cape Crozier to return from Scott's *Terra Nova* expedition, he cared for three precious eggs. Each of the eggs contained the embryo of an emperor penguin, which in the right hands might answer the question as to whether the penguin was a link between reptiles and birds. The journey was the idea of Wilson's and his enthusiasm was such that he managed to enlist Cherry-Garrard and Henry (Birdy) Bowers to join him on a long and exceedingly dangerous Antarctic journey in the depths of winter. Cherry-Garrard and Bowers suggest in their journals that they agreed out of friendship, loyalty, a sense of adventure and a little curiosity. For these reasons, the three men put their lives at continual risk in pursuit of solving a scientific problem. Having been so strongly invested in the fieldwork that yielded these three precious eggs, the sole survivor of the full expedition

(Bowers and Wilson were with Scott on his doomed return from the South Pole), Cherry-Garrard was most reluctant to leave those eggs in the hands of London's Natural History Museum. In his story of Scott's expedition, Cherry-Garrard devotes several pages to a description of his (poor) reception at the Natural History Museum and then to the science that resulted from the analysis of the embryos. Having been involved in the incredibly arduous field work, he had a strong desire to see this project through to conclusion. (Cherry-Garrard, 1994)

There were many early career scientists amongst the Antarctic expeditions of the Heroic Age. These young men had much to gain by being at the cutting edge of the science of the time and were afforded impressive mentorship. The chance for adventure was as likely to have contributed to the motivation of these scientists as was the opportunity of discovering a species or phenomenon which would launch their career. Aleksandr Kuchin, the young Russian employed by Amundsen to carry out oceanographic work had been recommended by Amundsen's own professor. Kuchin wrote to his father vowing "to work hard so that Amundsen will not regret taking a foreigner with him..." (Barr, 1985, p. 403). Having been informed, after the *Fram* had set sail, that he would be working on the South Atlantic Ocean rather than the North; Kuchin recorded excitement for the new plans, but disappointment that he would be unable to join the shore party as he would be carrying out his scientific work then. Some sources have perhaps unfairly labelled Amundsen as not being interested in science, despite the evidence that he had been a science student himself. In his own diary, Kuchin notes Amundsen's interest in science was overshadowed by the need to set a sporting goal for the expedition to raise the necessary funds. Kuchin, received the lowest pay of anyone on the *Fram*, yet his work from that expedition has been recognised as a significant contribution to the field of oceanography. It was not a financial incentive that motivated Kuchin, but the desire to be a part of the expedition, to reward the faith placed in him by doing well in his science (Barr, 1985; Bomann-Larson 2014; Helland-Hanson & Nansen, 2001; Huntford, 1993; Rack, 2015).

## The Incentive

The incentives that appear to have influenced scientists' decisions to take part in the Heroic Age expeditions include the chance to discover a new species or phenomenon, recognition from their peers and material to publish and publicise at a later date. It was not immediate financial gain that was an incentive, but the possibility of launching of a stellar career that provided motivation for embarking on such an expedition. Not only did Scott's expedition provide the vehicle for field work across many scientific disciplines, but afterwards it was widely published at a cost borne by the Scott Memorial Fund. The ability to carry out fieldwork and to publish leading edge research must be considered the one of the stronger incentives to any scientist (Bomann-Larsen, 2014; Helland-Hansen & Nansen, 2001; Kirwan, 1962; Riffenburgh, 2004).

Other incentives may have been the fame for oneself, pride in representing one's country or the possibility of a polar medal, but these do not appear to be the main source of motivation for these scientists according to extracts of their journals and in literary accounts of their expeditions. The most likely inducement for a scientist to forsake his current research and join an expedition to the Antarctic at the turn of the last century was the

possibility of discovery, with a consequential inducement of naming rights. Based out of their iced-in ship, the *Endurance*, Shackleton's team carried out as much scientific investigation as was possible.

*"...we heard a great yell from the floe and found Clark dancing about and shouting Scottish war cries. He had secured his first complete specimen of an Antarctic fish, apparently a new species."* (Shackleton, 2008, p. 47)

Whether part of a larger, organised team such as those who worked for Scott or Shackleton, or working almost alone as the scientists under Amundsen and Shirase did, the greater inducement for a scientist in the Heroic Age of Antarctic exploration must surely have been the chance to discover a previously unknown species or phenomenon (Cherry-Garrard, 1994; Huntford, 1993; Riffenburgh, 2004; Turney, 2012).

## The process of science; that which arouses, sustains and regulates human behaviour

The process of scientific exploration served to sustain the scientists of Shackleton's *Nimrod* expedition. The range of ages and physical condition of the men was a significant factor contributing to the hardship they endured in the field, as were the failures in logistics. Despite these barriers to success, the expedition delivered on a wide range of scientific achievements. Following the success of the *Nimrod* expedition, Mawson was inspired to carry out his own expedition with purely scientific goals, but had to fit his objectives around those of Scott's. Mawson's expedition proved to be an epic event in terms of human survival, underpinned by the driving force of scientific pursuit, but science was achieved nonetheless. Filchner's expedition was hampered by differences in opinions from science objectives through to where to base their operations. With the sea ice trapping Filchner's ship, the scientific team focused on the only option that remained; observations and data collection of their immediate surrounds (Bickel, 1977; Riffenburgh, 2004; Shackleton, 2008, Turney, 2012).

Scott and his scientists were captivated by science. On his journey to the South Pole, Scott found a site at Mount Buckley to be of such geological interest that camp was made. The specimens that his chief scientist, Wilson, found included fossils of significance to the understanding of the link between Antarctica and Gondwana. Although many people consider the carrying of geological samples on this journey contributed to the ill fate of the party, these samples have contributed to the wealth of scientific knowledge. Throughout Scott's race for the pole, continual scientific research and monitoring was carried out. Bowers must have been the most exhausted member of the final team of five as he was the only man without skis, yet he was unfailing in recording regular, thorough meteorological readings throughout his journey. In his analysis of the expedition, Cherry-Garrard shows his understanding science as a motivator, arousing, sustaining and regulating the behaviour of scientists:

*Some will tell you that you are mad, and nearly all will say, "What is the use?" For we are a nation of shopkeepers, and no shopkeeper will look at research which does not promise him a financial return within a year. And so you will sledge nearly alone, but those with whom you sledge will not be shopkeepers: this is worth a good deal. If you*

*march your Winter Journeys you will have your reward, so long as all you want is a penguin's egg.* (Cherry-Garrard, 1994, pp. 597-598)

(Cherry-Garrard, 1994; Tingey, 1983)

## Limitations

To appreciate the motivation of each of the scientists who explored Antarctica in the Heroic Age, a combination of the diaries or journals, scientific logs and extrapolation of conditions endured from meteorological and logistics records would be required. In most cases, the accounts of these expeditions are vignettes rather than complete pictures. Discussions of these expeditions can show differences in the interpretation of details of events. Cherry-Garrard made a valiant attempt to give a complete picture in his description of the Western party of the *Terra Nova* expedition. Such a considered investigation into the life of the Heroic Age Antarctic scientists would be needed to be able to generalise on the personal drive of more scientists of that time and on individual responses to the process of science in Antarctica. Journals, published scientific papers and biographical accounts of those expeditions do highlight the need for a strong personal drive to live and to work in the extreme conditions Antarctic expeditions of the Heroic Age.

## Conclusion

The scientists that travelled on the Antarctic expeditions of the Heroic Age were brave and enthusiastic men, eschewing the comforts of a more civilised life for the chance to explore and the hope to discover. The expedition leaders and the senior scientists provided the incentive and the instance of motivation for the pursuit of Antarctic science, whether it was the funding, the mentorship or purely the logistical support for the science to be carried out. The motivation provided through leadership, and the possible incentives of success, were contributing factors, but not necessarily the major factors, in the motivation of the Antarctic scientists of the Heroic Age. The more likely major factors that provided the underlying motivations of a scientist participating in an Antarctic expedition in the decade from 1907 were, to a greater extent, personal drive and the process of science itself. These men, themselves, had to have their own interest in the pursuit of science, sufficient to overcome the demands of the extreme environment and the limited society within which they would be working. In some groups, most notably those of Shackleton's *Nimrod*, *Aurora* and *Endurance* expeditions, the balance of personnel and logistics worked against the ability of science alone to arouse, sustain and regulate human behaviour. In the main, the combination of the unique environment, the chance to be the first to discover, the mix of like-minded individuals on the Antarctic expeditions of the Heroic Age, allowed science to be carried out, resulting in an extensive body of scientific work that formed a solid foundation for understanding Antarctica.

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